CCR Number: 0025	CRITICALITY: ROUTINE	DUE:12/15/98

DISTRIBUTION SHEET
EO-1 LEVEL II CCB

Matt Jurotich/EO-1 Payload Manager

Pete Spidaliere/EO-1 Mission Mgr

Nick Speciale/EO-1 Mission Technologist

Ken Perko/567

F. Pellerano/GSFC

Mark Perry/SWALES

M. Cully/GSFC

M. Kelley/GSFC

K. Fielhuer/Litton

NEW MILLENNIUM PROJECT CONFIGURATION CHANGE REQUEST

PROGRAM EO-1
CCR NO. 0025
DATE INITIATED 11/30/98

TITLE CHANGES TO EO-1 XPAA ICD-47
ORIGINATOR K. Perko/EO-1/567
ORIGINATOR'S CHG. NO.
SPONSOR/CODE Ken Perko PHONE x6375

EFFECTIVITY
ITEM: EO-1//XPAA
S / N
ITEM:
S / N
ITEM:
S / N

CHANGE CLASS

	I	II
PRELIMINARY	☐	☐
FORMAL	☐	☐

TYPE OF CHANGE

MILESTONE	☐	INTERFACE	☒	SOFTWARE	☐
DOCUMENT	☒	POWER	☐	OTHER	☐
COST ____	☐	WEIGHT	☐	____	☐

DOCUMENTS OR SOFTWARE AFFECTED
EO-1X-Band Phased Array Antenna

PROBLEM
The attached Preliminary Interface Revision Notice (PIRN) contains changes to the X-Band Phased Array Antenna (X-PAA) Interface Control Document (ICD). This PIRN includes suggested changes that will be incorporated as a revision to the document. The PIRN will become an official Level II ICD change once the EO-1 project Configuration Control Board (CCB) chairman signs this CCR and the attached PIRN.

PROPOSED SOLUTION
Approve the attached PIRN 001 to EO-1 X-PAA ICD-047 by the EO-1 Level II Configuration Control Board (CCB). The signed PIRN will serve as the official approval of changes to this ICD. Future changes will be initiated by submittal of Configuration Change Requests (CCRs) and PIRN for CCB approval. This document is maintained by the EO-1 Configuration Management Office (CMO).

BOARD ACTION
- APPROVE ☐
- APPROVE WITH CHANGE ☒
- DISAPPROVE ☐
- WITHDRAW ☐

APPROVAL LEVEL REQUIRED
- LEVEL I HQS ☐
- LEVEL II GSFC ☒
- LEVEL III ☐

CRITICALITY LEVEL
- EMERGENCY ☐
- URGENT ☐
- ROUTINE ☒

PROCUREMENT CHANGE ORDER CLASSIFICATION

ROUTINE		URGENT		EMERGENCY	
OPTION 1	☐	OPTION 1	☐		
OPTION 2	☐	OPTION 2	☐		

COMMENTS
Approve with change resulting in PSCN0018 to ICD-47

CHAIRPERSON _____ DATE 2/22/99

3/28/96

GODDARD SPACE FLIGHT CENTER		1. PAGE 1 OF 26
PRELIMINARY SPECIFICATION CHANGE NOTICE (PSCN) No._____ or **PRELIMINARY INTERFACE REVISION NOTICE (PIRN)** No. 001R1		2. INIT. DATE: 11/30/98 3. CONTRACT NUMBER
4. ASSOCIATED CONTROL NUMBERS: **EO-1CCR 0025**	5. CI'S AFFECTED: XPAA ICD-047	6. DOCUMENT NUMBER: REVISION:

7. DESCRIPTION OF CHANGE:

See Attached pages for changes to ICD-47

PREPARED BY: S.Schneider/442	ORIGINATING ORGANIZATION APPROVAL:	ORGANIZATION:	DATE:
HST CCB ACTION ✓ APPROVED: ____ DISAPPROVED: ____	SIGNATURE:	DATE: 2/22/99 MINUTES No:	

EO-1 CCR 0025
PIRN 0001 ICD-047

1) Add: in Section Table of Contents: 7.5.4 Antenna Mechanical Drawings

2) Delete: The following in Section 1.3 Applicable Documents:

i. Litton Document ICD TBD, "X-Band Exciter to Memory Interface Control Card."

3) Add: The following in Section 1.3 Applicable Documents:

AM149-0117(285), X-Band Phased Array Antenna Remote Services Node Software Specification.

4) Change Section 3.1 General

From:

General
The antenna enclosure is a two level structure. The 64 radiating elements and the high wattage dc to dc converters for the antenna 5V power are located on the upper level, and an RSN controller board is located on the lower level. The lower level of the enclosure is geometrically identical to one slot of the Litton Chassis (Litton drawing No. 184622) permitting the generic RSN board to be accommodated without any mechanical change to the basic RSN.

To:

General
The antenna enclosure is a two level structure. The 64 radiating elements and the high wattage dc to dc converters for the antenna 5V power are located on the upper level, and an RSN controller board is located on the lower level. **Six dc-to-dc converters, including the high wattage units for the antenna 5V power, are located on the RSN board or heat sink.** The lower level of the enclosure is geometrically identical to one slot of the Litton Chassis (Litton drawing No. 184622) permitting the generic RSN board to be accommodated without any mechanical change to the basic RSN.

5) Change Section 3.2 Antenna Envelope:

From:

Figure ~~8-1~~ shows the physical envelope of the antenna. The RF excitation input is located on the -X direction face of the antenna. The service connector and the fiber optic connectors are located

on the positive Y direction face. The test connector is located on the negative Y direction face. The antenna coordinate system (relating x, y, and z directions to steering angle phi and theta) is described in AM149-0117(285), "X-Band Phased Array Antenna Remote Services Node Software Specification."

To:

Figure **8-1** shows the physical envelope of the antenna. The RF excitation input is located on the -X direction face of the antenna. The service connector and the fiber optic connectors are located on the positive Y direction face. **The test connector is located on the negative Y direction face. The antenna coordinate system (relating x, y, and z directions to steering angle phi and theta) is described in AM149-0117(285), "X-Band Phased Array Antenna Remote Services Node Software Specification."**

6) Change Section 3.3 Antenna Foot print and Fastener Requirements

From:

Figure ~~8-2~~ shows the mechanical footprint of the antenna. The antenna is secured to the mounting plate by 8 NES 1578 ¼-28 threaded fasteners.

To:
Figure **7-6** shows the mechanical footprint of the antenna. The antenna is secured to the mounting plate by 8 NES 1578 ¼-28 threaded fasteners.

7) Change Section 3.4 Antenna Mounting Requirements:

A gasket of Chomerics Cho-Therm 1671 will be placed between the antenna flange and the mounting plate, and the ¼-28 fasteners torqued to 91 in lb.

To:

A gasket of Chomerics Cho-Therm 1671 will be placed between the antenna flange and the mounting plate. **An EMI shielding gasket, Spira Shield SS-04, will be placed in the groove provided in the antenna mounting flange. The ¼-28 fasteners are torqued to 91 ins-lbs. Figures 4-1 and** Error! Reference source not found. **illustrate the details of the mounting configuration.**

8) Change Section 3.5 Antenna Mass and Center of Mass:

From:

The antenna shall weigh not more than 5.5 kg. The center of mass shall be determined to an accuracy of +-2.5mm in three dimensions.

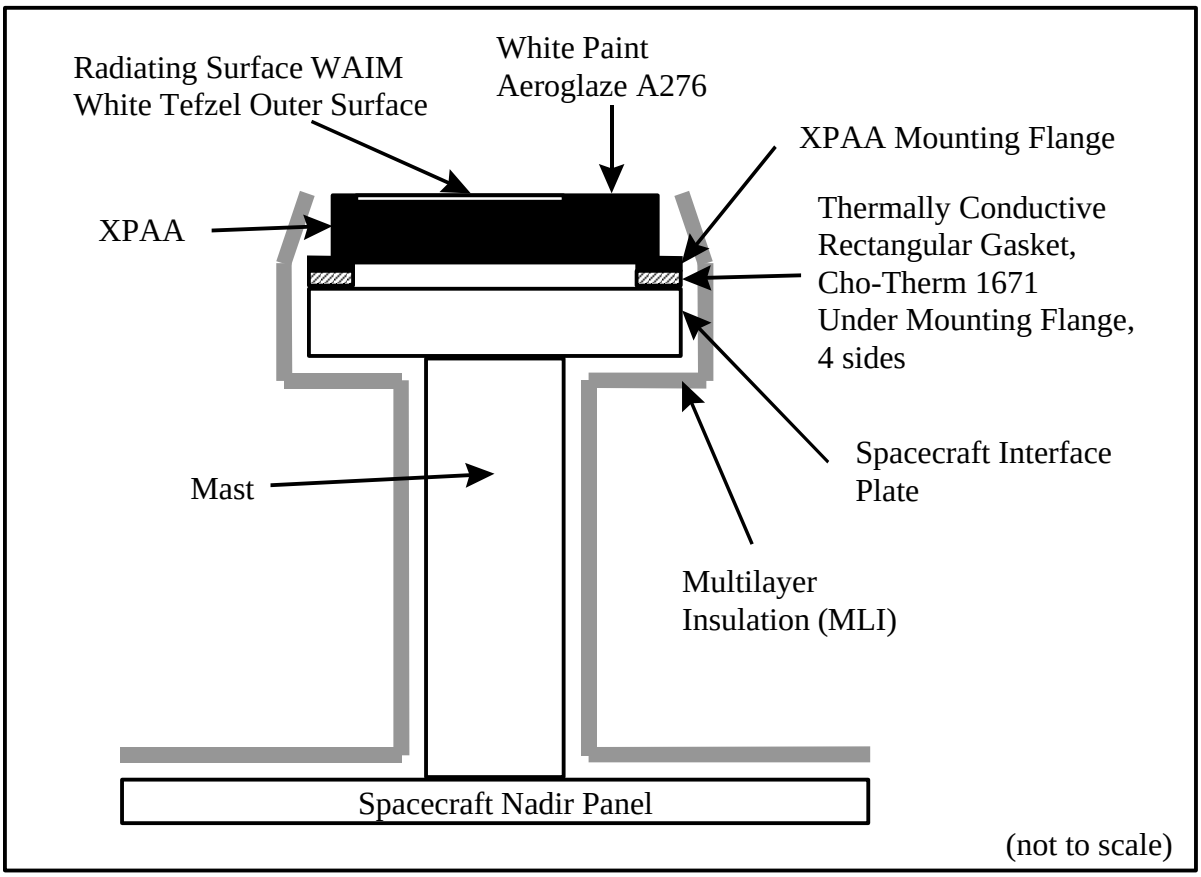
To:

Antenna Mass:

The Antenna weighs 5.56kg.

9) Change Figure 4-1 XPAA THERMAL INTERFACES:

From:



To:

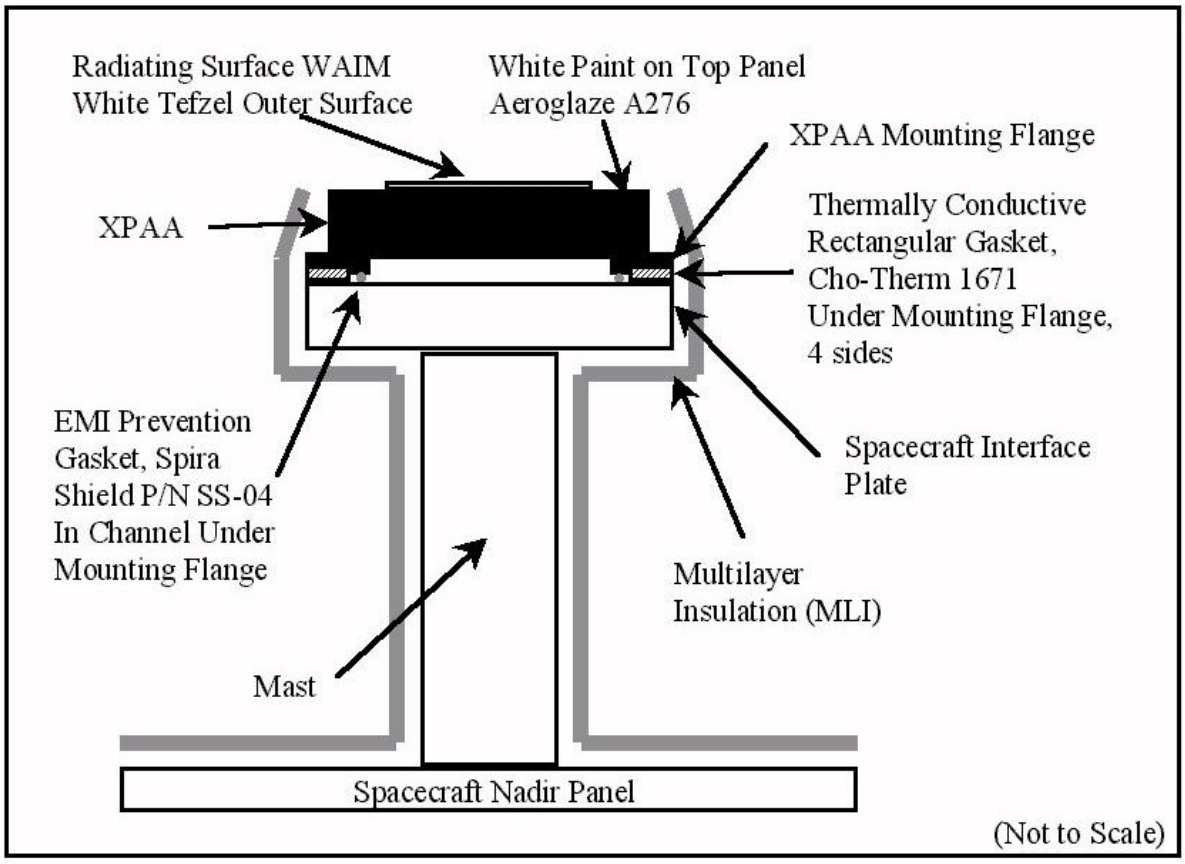


Figure Error! No text of specified style in document.**-1 XPAA Thermal Interfaces**

10) Change Section 5.3 RF INTERFACE

From:

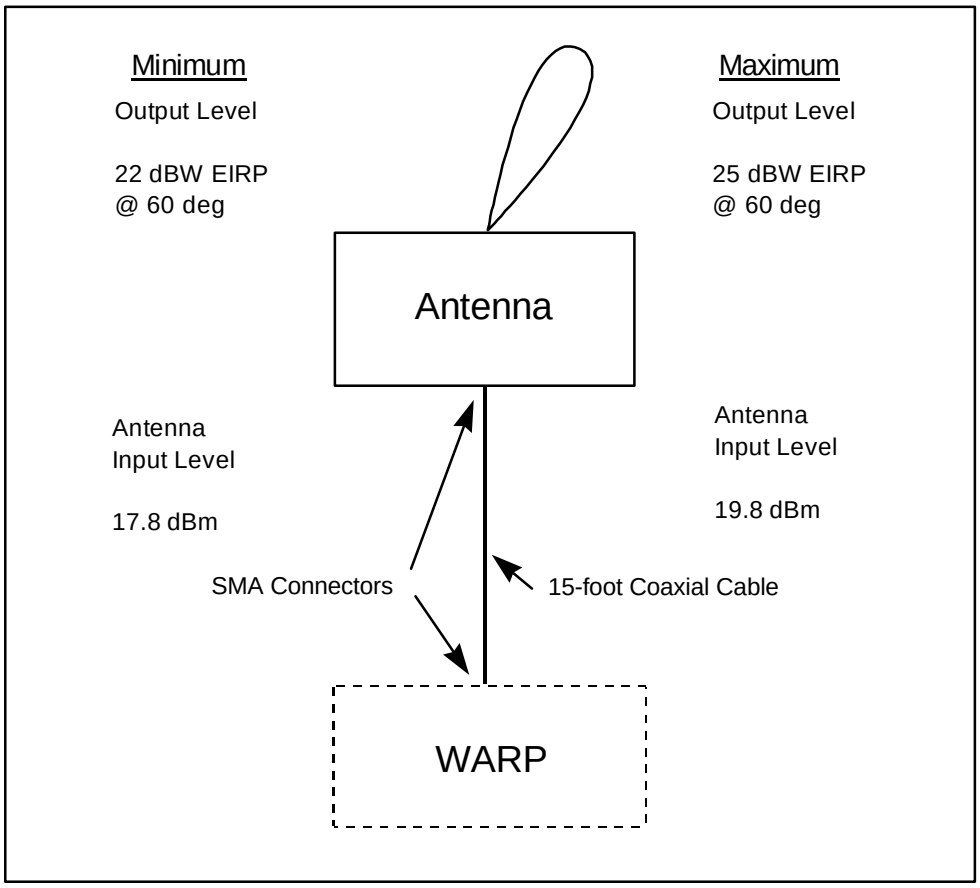
Figure 5-3 shows the system RF allocations. The excitation is described in the Litton Exciter Specification, document number TBD. The input interface connector is a female SMA connector mounted at the center of the +Y face of the enclosure. The connector should be tightened to 6 in-lb.

To:

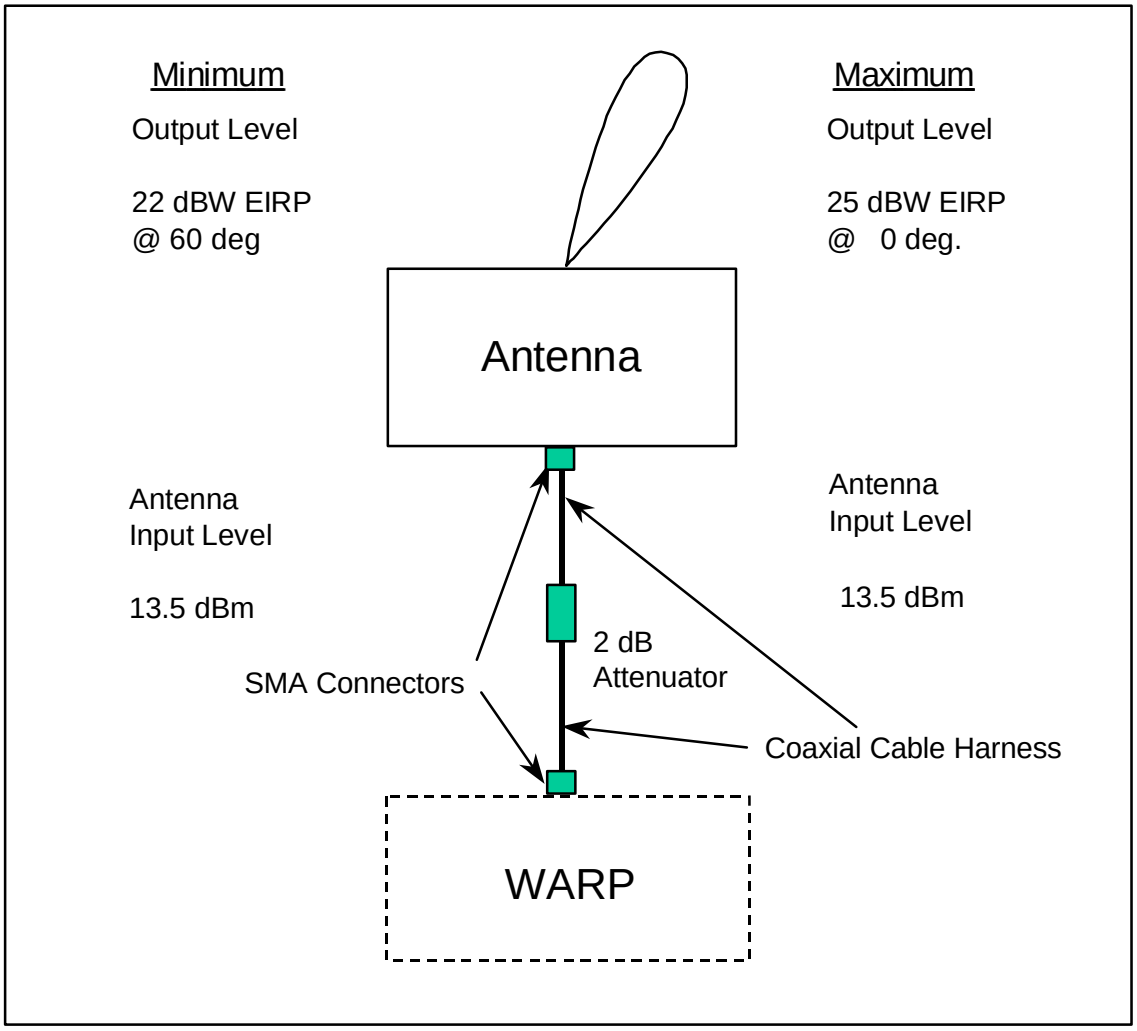
Figure 5-3 shows the system RF allocations. The excitation is described in the table of requirements in the Litton Exciter Screening Test Specification, **document number 5503158**. The input interface connector is a female SMA connector mounted on the **–X edge of the enclosure close to the corner with the +Y edge.** The connector should be tightened to 6 ins-lbs.

11) Change Figure 5-3 RF ALLOCATIONS:

From:



To:


Minimum
Output Level
22 dBW EIRP
@ 60 deg
Maximum
Output Level
25 dBW EIRP
@ 0 deg.
Antenna
Antenna
Input Level
13.5 dBm
Antenna
Input Level
13.5 dBm
2 dB
Attenuator
SMA Connectors
Coaxial Cable Harness
WARP

12) Change Section 5.4 Maximum RF Power into the Antenna:

From: RF excitation power applied to the RF input connector (J1) must not exceed 500 mW or 27dBm.

To: RF excitation power applied to the RF input connector (J1) must not exceed ~~500~~ **100**mW or ~~27~~ **20**dBm.

13) Change Section 5.5 DC Power Requirements:

From:

The nominal dc power requirement is 44 W with a worst case of 60 W while transmitting. The antenna will operate over an input voltage range of 21 to 35 V with source impedance, transients, and ripple in accordance with the statement of work (SOW). The interface connector is J6, type 311P 409-1P, and the pin assignment is discussed in Section 5.9. When not transmitting, the ESN and 1773 interface draw approximately 3 W.

To:

The nominal dc power requirement is 44 W with a worst case **(mounting plate temperature = 0 degrees c, prime power voltage = 35 v)** of ~~60~~ **56** W while transmitting. The antenna will operate over an input voltage range of 21 to 35 V with source impedance, transients, and ripple in accordance with the statement of work (SOW). The interface connector is J6, type 311P 409-1P, and the pin assignment is discussed in Section 5.9. When not transmitting, the ESN and 1773 interface draw approximately ~~3~~ **5** W.

14) Change Section 5.8 EMI/RFI

From:

The antenna will satisfy conducted and radiated emission and conducted and radiated susceptibility requirements as specified in NASA document 737-EO1-SOA-XPAA.

To:

The antenna will satisfy conducted and radiated emission and conducted and radiated susceptibility requirements as specified in ~~NASA document 737-EO1-SOA-XPAA~~. **AM-149-0020(155).**

15) Change Section 5.9 List of Connectors:

From:

The antenna external interfaces are implemented with the connectors listed in Table 5-1. Connector pin-outs are listed in Tables 5-2 through 5-4.

Table 5-1. Antenna Connectors

Connector Number	Connector Type	Pins Used	Description
J1	SMA	-	RF excitation input
J2	FC	Fiber	1773 Bus A input
J3	FC	Fiber	1773 Bus A output
J4	FC	Fiber	1773 Bus B input
J5	FC	Fiber	1773 Bus B output
J6	311-P409-1PB-15 9-pin D-type male	1,5,6,9	28 V input power
J7	311-P407-3S-B-15 44-pin D-type female	TBD	Service connector
J8	311-P407-3S-B-15 44-pin D-type female	All	Test connector

To:

The antenna external interfaces are implemented with the connectors listed in Table 5-**9**-1. Connector pin-outs are listed in Tables 5-**9**-2 through 5-**9**-4.

Table 5-1. Antenna Connectors

Connector Number	Connector Type	Pins Used	Description
J1	SMA	-	RF excitation input
J2	FC	Fiber	1773 Bus A input
J3	FC	Fiber	1773 Bus A output
J4	FC	Fiber	1773 Bus B input
J5	FC	Fiber	1773 Bus B output
J6	311-P409-1PB-15 9-pin D-type male	1,5,6,9	28 V input power

J7	311-P407-3S-B-15 44-pin D-type female	~~TBD~~ **1,2,9,10,11, 12,13,14,15, 16,17,18,19, 20,21,22,23, 24,25,26,27, 28,29,30,31, 32,39,40,41, 42,43,44**	Service connector
J8	311-P407-3S-B-15 44-pin D-type female	All	Test connector

16) Add: The following Table 5.9.2 Connector j6 Pin-Outs:

Table Error! No text of specified style in document.**-1 Connector J6 Pin-Outs**

Pin Number	Function	Description
1	EPROM1	
2	GND	
3	SPARE	
4	SPARE	
5	SPARE	
6	SPARE	
7	SPARE	
8	SPARE	
9	BPC0	
10	BPC1	
11	BPC2	
12	GND	
13	BTXD1+	
14	BTXD0+	
15	BTXD0-	
16	EEPROM2	
17	WDT1	
18	GND	
19	MODE	
20	PRA	
21	PRB	
22	SD1	
23	DCLK	
24	GND	
25	BPC3	
26	BPC4	
27	GND	
28	BTXD1-	
29	BRXD0+	
30	BRXD0-	
31	WDT2	
32	GND	
33	SPARE	
34	SPARE	
35	SPARE	
36	SPARE	

37	SPARE	
38	SPARE	
39	BCP5	
40	BCP6	
41	BCP7	
42	GND	
43	BRXD1+	
44	BRXD1-	

17) Change Section 6 Software Interface:

From:

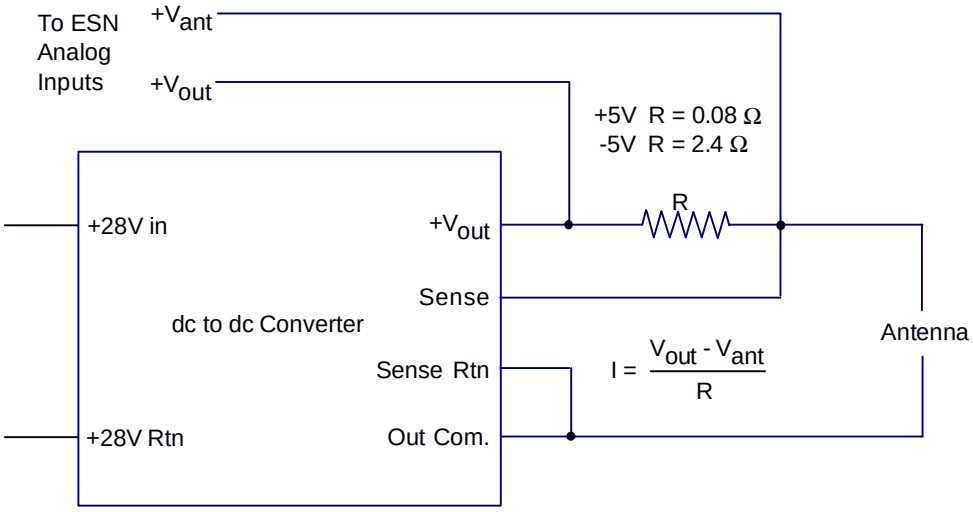
The software requirements are described in Boeing Document XPAA-093.

To:

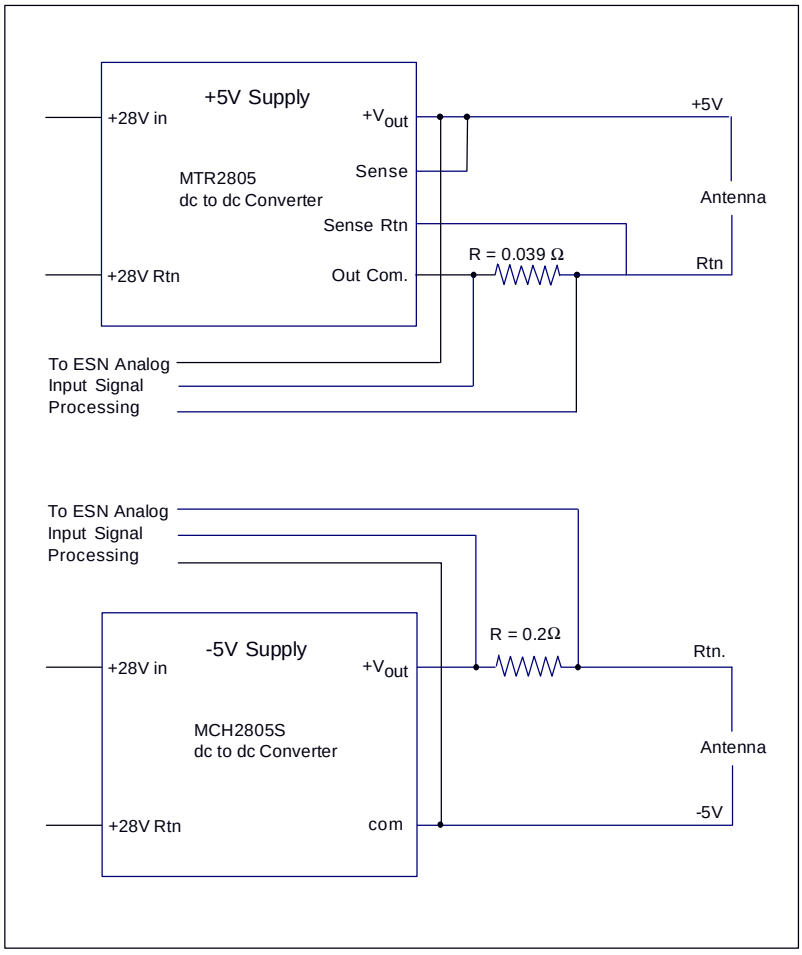
The software requirements are described in Boeing **Software Specification** Document ~~XPAA-093.~~ **AM149-0117(285), "X-Band Phased Array Antenna Remote Services Node Software Specification."**

18) Change Figure 7-1 Antenna Power Supply Voltage Current Measurement Network

From:



To:


+5V Supply
+28V in
+28V Rtn
+V_{out}
Sense
Sense Rtn
Out Com.
MTR2805
dc to dc Converter
+5V
Antenna
Rtn
R = 0.039 Ω
To ESN Analog
Input Signal
Processing
To ESN Analog
Input Signal
Processing
-5V Supply
+28V in
+28V Rtn
+V_{out}
com
MCH2805S
dc to dc Converter
R = 0.2Ω
Rtn.
Antenna
-5V

19) Change Section 7.2.2 Array Currents:

From:

The +5 V and -5 V currents supplied to each side antenna array are obtained as shown in Figure 7-1 by measuring the voltage drop across a resistor in series with the dc-to-dc converter and the antenna. The series resistors are chosen to provide a 2-percent precision current measurement assuming 0 V to +10 V and +10 V to -10V analog voltage ranges for the +5 V and -5 V lines, respectively, and 12-bit A-to-D conversion.

To:

The +5 V and -5 V currents supplied to each side antenna array are obtained as shown in Figure 7-1 by measuring the voltage drop across a resistor in series with the dc-to-dc converter and the antenna. The series resistors are chosen to provide a 2-percent precision**.** ~~current measurement assuming 0 V to +10 V and +10 V to -10V analog voltage ranges for the +5 V and -5 V lines, respectively, and 12-bit A-to-D conversion.~~

20) Change Section 7.2.3 Temperature Measurements:

From:

The temperatures of the center of the array pressure plate and the ESN lid will be measured using thermistors as shown in Figure 7-2.

To:

The temperatures of the center of the array pressure plate**, the RSN heat sink,** and the ESN lid will be measured using thermistors as shown in Figure 7-2.

21) Change Table 7.3.1 Measured Parameter Values and Ranges:

From:

Parameter	Expected Value	Acceptable Range	Failure Mode Identified
+5 V antenna side A	5.0 V	+/- 0.1 V	Power supply/catastrophic hardware failure
+5 V antenna side B	5.0 V	+/- 0.1 V	Power supply/catastrophic hardware failure
-5 V antenna side A	-5.0 V	+/- 0.1 V	Power supply/catastrophic module failure
-5 V antenna side B	-5.0 V	+/- 0.1 V	Power supply/catastrophic module failure
Positive current side A	3.0 to 3.9 A*	+/- 0.3 A^{+}	Module failure
Positive current side B	3.0 to 3.9 A*	+/- 0.3 A^{+}	Module failure
Negative current side A	-90 to -130 mA*	+/- 10 mA^{+}	Module failure, single-event latch-up
Negative current side B	-90 to -130 mA*	+/- 10 mA^{+}	Module failure, single-event latch-up
Pressure plate temperature	10^{o}C above cold plate*	+2^{o}C > expected T	Module failure
ESN lid temperature	TBD	TBD	TBD
Phase bit array	Precalculated values	No variation	RSN failure, software error

NOTES: * = nominal values; final values determined after integration and testing
$^{+}$ = will depend on array temperature

To:

Parameter	Expected Value	Acceptable Range	Failure Mode Identified
+5 V antenna side A	5.0 V	+/- 0.1 V	Power supply/catastrophic hardware failure
+5 V antenna side B	5.0 V	+/- 0.1 V	Power supply/catastrophic hardware failure
-5 V antenna side A	-5.0 V	+/- 0.1 V	Power supply/catastrophic module failure
-5 V antenna side B	-5.0 V	+/- 0.1 V	Power supply/catastrophic module failure
Positive current side A	~~3.0~~ **2.6** to 3.9 A*	+/- ~~0.3~~ 0.**2** A **of expected**$^{+}$	Module failure
Positive current side B	~~3.0~~ **2.6** to 3.9 A*	+/- ~~0.3~~ 0.**2** A **of expected**$^{+}$	Module failure
Negative current side A	~~-90~~ **-100** ~~to -130~~ mA*	+/- ~~10~~ **2** mA^{+}	Module failure, single-event latch-up
Negative current side B	~~-90~~ -**100** ~~to -130~~ mA*	+/- ~~10~~ **2** mA^{+}	Module failure, single-event latch-up
~~Pressure~~ **Base** plate temperature	~~10~~ **3**^{o} C above cold plate*	+2^{o}C > expected T	Module failure
RSN HEAT SINK TEMP	**8 deg Above Cold Plate**	**+2 deg c > expected T**	**N/A**

ESN lid temperature	~~TBD~~ **5 deg c above RSN base**	~~TBD~~ **+2 deg c > expected T**	~~TBD~~ **N/A**
Phase bit array	Precalculated values	No variation	RSN failure, software error

NOTES: * = nominal values; final values determined after integration and testing
+ = will depend on array temperature

22) Section 7.5.3 Electrical Design

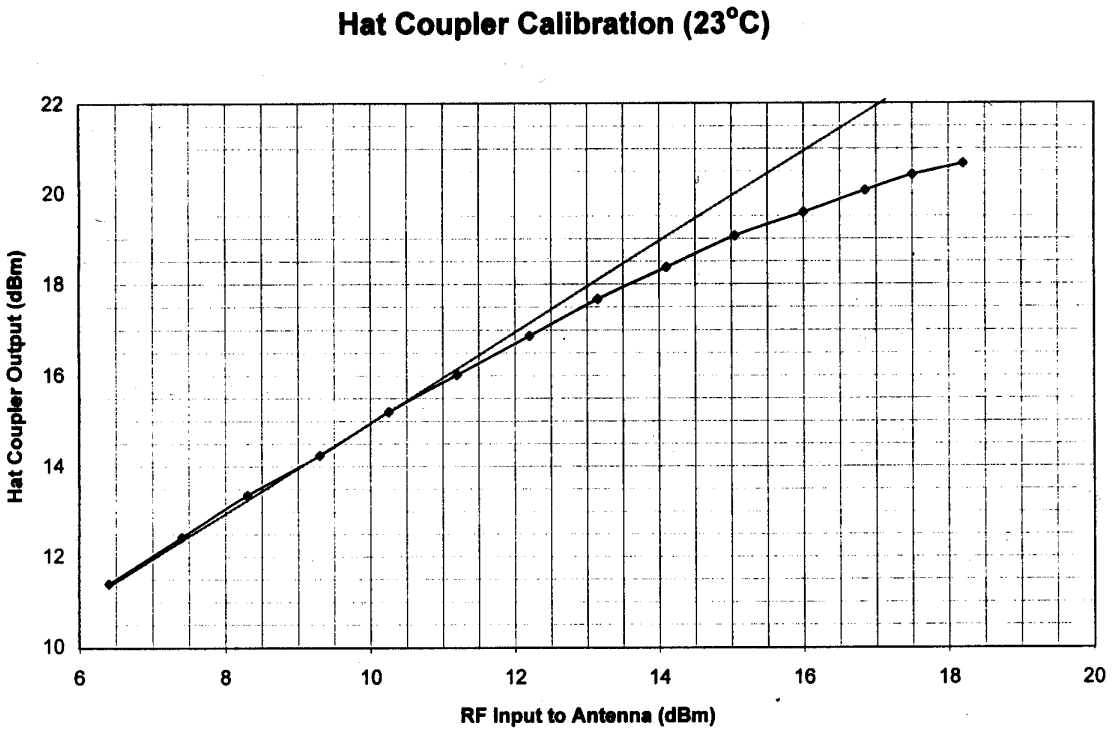
From:

The probe in the center of the lid of the hood couples a small fraction of the radiated power. The connector is a UG-58A N-series female panel mount connector. The coupling coefficient is of the order of -20 dB. The value of the coefficient will be revised after final testing of the antenna at Boeing.

To:

The probe in the center of the lid of the hood couples a small fraction of the radiated power. The connector is a UG-58A N-series female panel mount connector. The coupling coefficient ~~is of the order of -20 dB. The value of the coefficient will be revised after final testing of the antenna at Boeing.~~ **when the antenna is set to point at boresight is approximately 38 dB below the EIRP at boresight. The curve in Figure 7-3 relates the output of the coupler to the RF input array, as measured by Boeing during acceptance tests.**

23) Add: The following Figure 7-3 HAT Coupler Calibration



24) Add: The following Antenna Mechanical Drawings:

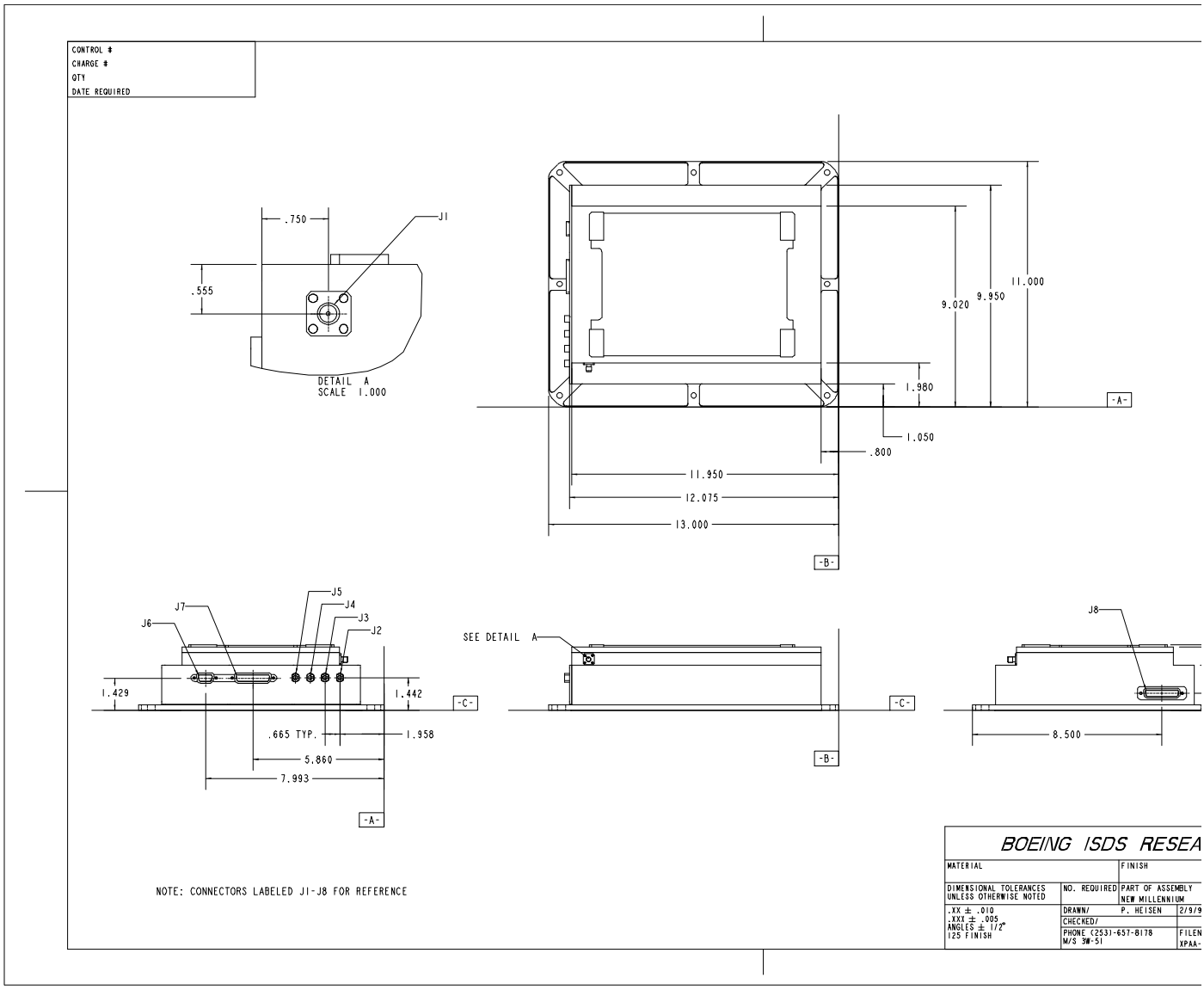


Figure 8-1. Antenna Mechanical Drawing

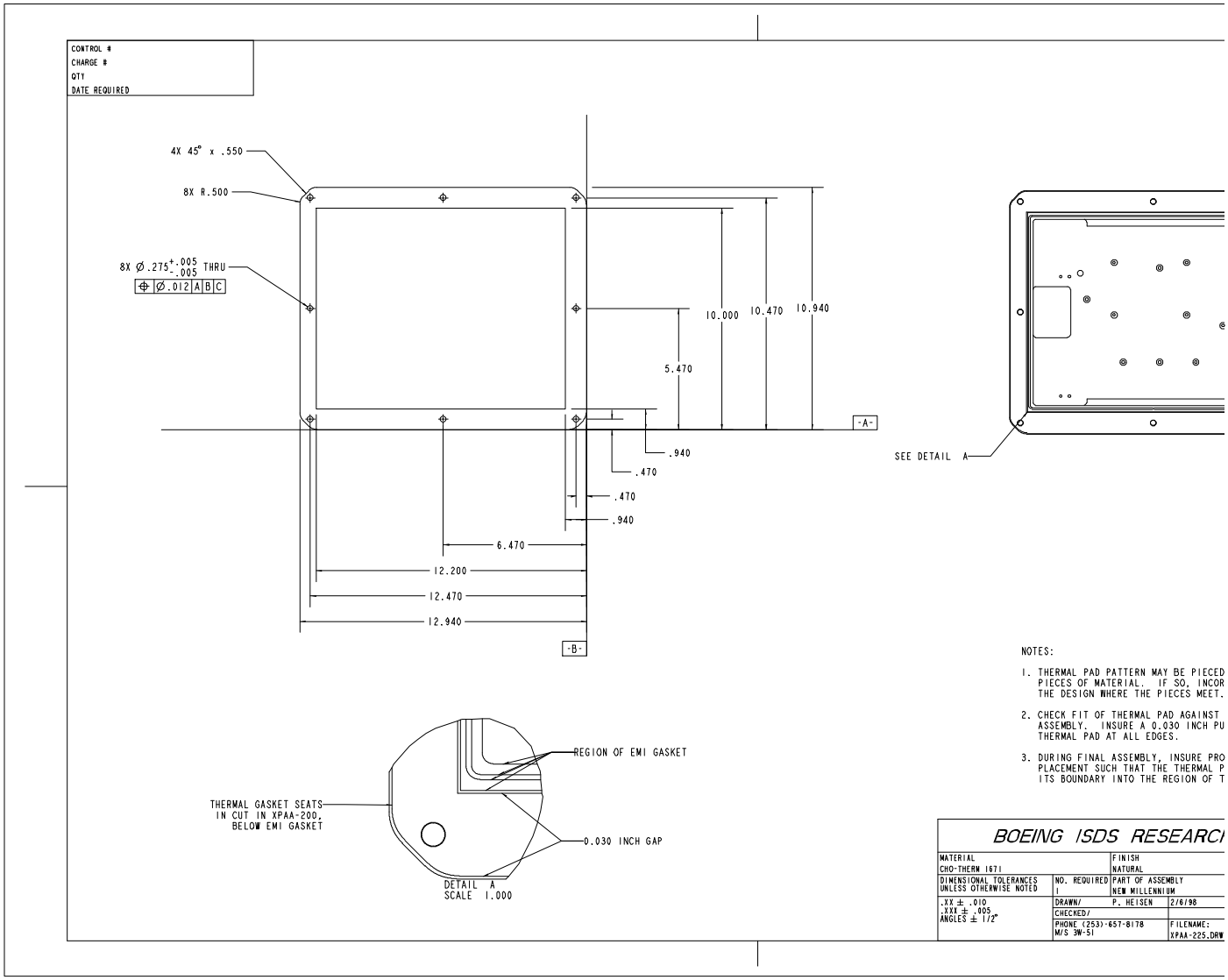
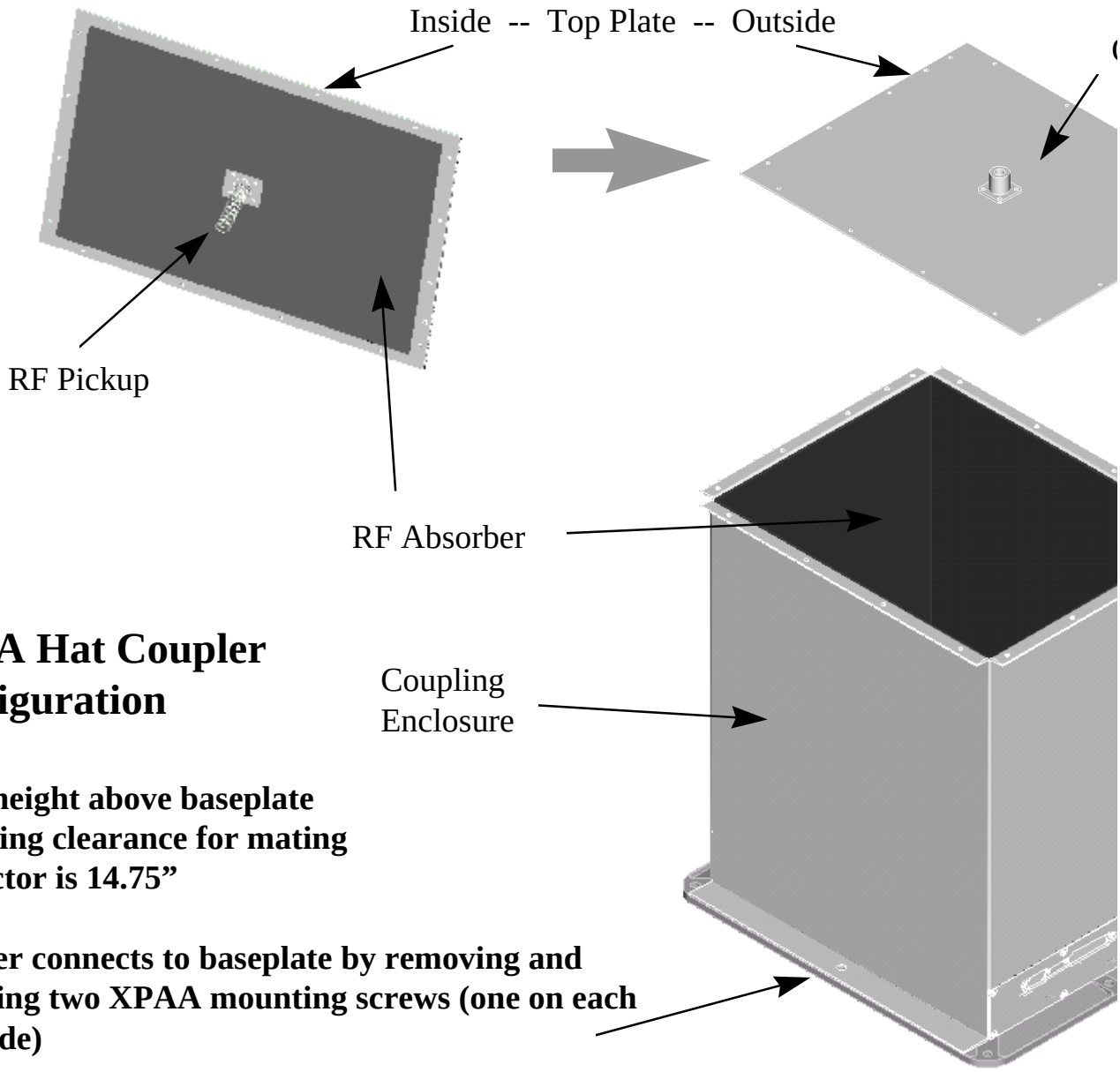


Figure 8-2. Antenna Footprint



XPAA Hat Coupler Configuration

Total height above baseplate excluding clearance for mating connector is 14.75”

Coupler connects to baseplate by removing and replacing two XPAA mounting screws (one on each long side)

Figure 8-3. Test Hood

Date: Tue, 01 Dec 1998 10:19:11 -0500 (Eastern Standard Time)
From: Administrator <administrator@hst-nic.hst.nasa.gov>
Reply-to: (Fernando Pellerano/567)
Subject: CCR:0025 - DUE: 12/15/98   ROUTINE Level-2 Fernando Pellerano/56 WWW-COMMENTS

USER :   (Fernando Pellerano/567) sent the following comments on :

Date: 12/1/98
CCR Number: 0025
Sponsor: Ken Perko
Due Date: 12/15/98

CCR Title: CHANGES TO EO-1 XPAA ICD-47

Remote host: 128.183.156.217 Email Address: pelleran@jazzman.gsfc.nasa.gov
---
APPROVAL STATUS: APPROVED WITH COMMENTS
Note:

COMMENTS: 1. Change #10 RF Interface: The torque specification for SMA connectors of 6 in-lbs is incorrect. Standard SMA connectors require 8 in-lbs of torque, and GSFC has used 12 in-lbs for flight (based on inputs from Gore and Omni-Spectra). Flight connections shall also be striped with Uralane or equivalent.

2. Change #7: The new paragraph is missing a Figure reference.

3. Change #9: The new Figure for "XPAA Thermal Interfaces" is missing the Figure number.

4. Change #16: The Table is missing the Table number.

CCR SPONSOR RECOMMENDATION FORM

CCR NUMBER: 0025
CCR TITLE: Changes to EO-1 XPAA ICD-47

CCR SPONSOR: Ken Perko/GSFC/567

SUMMARY OF COMMENTS RECEIVED: (list Level 4 CCB and internal reviewers who had comments and address those comments)

1)Fernando Pellerano/567: Change #10 RF Interface: The torque specification for SMA connectors of 6 in-lbs. is incorrect. Standard SMA connectors require 8 in-lbs of torque, and GSFC has used 12 in-lbs for flight (based on inpurs from Gore and Omni-Spectra). Also, add the following at the end of the paragraph: Flight connections shall also be striped with Uralane or equivalent.

Sponsor Comment: **Agree.** Change item Number 10 from: "The connector should be tightened to 6 ins-lbs." TO: The connector should be tightened to **8** ins-lbs. Add :**Flight connections shall be striped with Uralane or an equivalent.**

2)Change # 7 : The new paragraph is missing a Figure reference.
Sponsor Comment: This will be addressed by Tech Pubs when the document is updated.

3)Change # 9: The new Figure for "XPAA Thermal Interfaces" is missing the Figure number.
Sponsor Comment: This will be addressed by Tech Pubs when the document is updated

4)Change # 16: The Table is missing the Table number.
Sponsor Comment: This will be addressed by Tech Pubs when the document is updated

Sponsor Recommendation: **Approve with change.** Add the above referenced changes.

SPONSOR/ORGANIZATION: Ken Perko/567
DATE: 1/7/99